

# Comparing the 'When' and the 'Where' of Electrocortical Activity in Patients with Tourette Syndrome, Body-Focused Repetitive Behaviors, and Obsessive Compulsive Disorder



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## Introduction

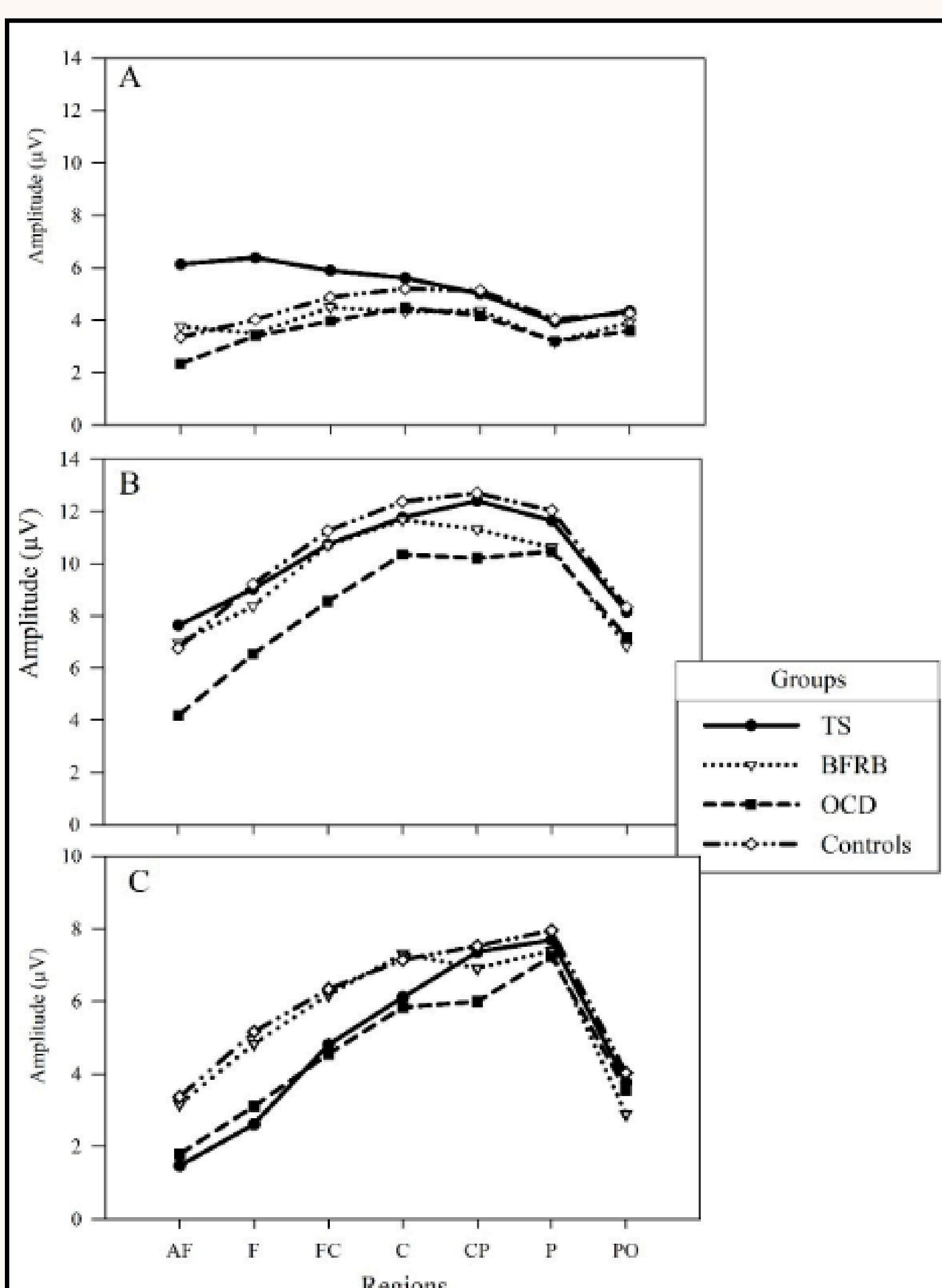
Tourette Syndrome (TS), Obsessive Compulsive Disorder (OCD) and Body-Focused Repetitive Behaviors (BFRB) share many similarities on a neuroanatomical and a functional (e.g. altered Cortico-Striato-Thalamo-Cortical Loop), a behavioral (e.g. repetitive behaviors) and a psychological (e.g. premonitory urges) levels. Thus, those could be part of a same **spectrum**.

Studying neurocognitive processes through Event-Related Potentials (ERPs) provides precise temporal resolution for assessing brain activity. ERP components can reflect specific processes that may be impacted by these disorders.

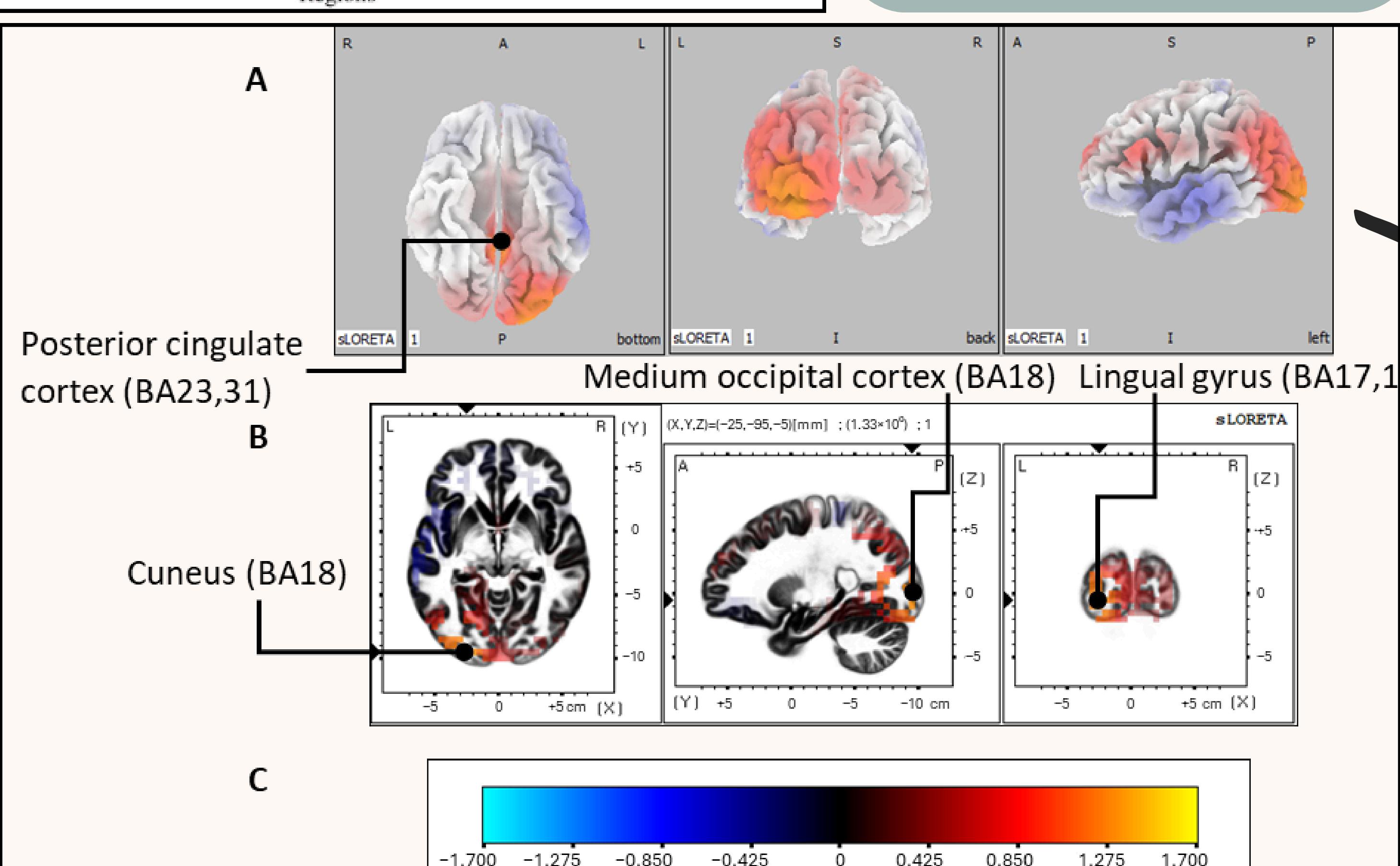
**AIMS :** Our first goal is to characterize '**WHEN**' in the processing stream group differences are the most prominent. The second goal is to identify '**WHERE**' in the brain the group discrepancies could be.

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## Results



The TS group shows a larger amplitude in frontal regions in the frequent condition (A), while the OCD group shows a more distributed amplitude decrease in the rare condition (B). These two different activation patterns result in a **decreased oddball P300 effect (rare-frequent) for the TS and OCD groups** compared to the control and BFRB groups (C). AF : antero-frontal ; F : frontal ; FC : fronto-central ; C : central ; CP : centro-parietal ; P : parietal ; PO : parieto-occipital.



**Activations of the P300 oddball effect P300 for the OCD group.** A) Axial (ventral), coronal (caudal), and sagittal (left hemisphere) slices. B) Significant activations in the cuneus (BA18), lingual gyrus (BA17 and BA18), middle occipital gyrus (BA18), and in the posterior cingulate cortex (BA23,31). C) Color legend corresponds to the voxel value.

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## Method

	TS (n = 24)	BFRB (n = 16)	OCD (n = 18)	Controls (n = 59)	ANOVA
Age (years)	37 (11)	41 (15)	43 (15)	38 (12)	ns
Sex (M/F)	16/8	3/13	11/7	41/18	BFRB vs. TS (p=.009) BFRB vs. OCD (p=.048) BFRB vs. Controls (p=.001)
Intelligence (Raven's Progressive Matrices)	82 (22)	81 (16)	74 (29)	82 (19)	ns
Laterality	19/2	12/2	16/2	58/0/1	ns
Anxiety (BAI)	9 (6)	10.1 (7)	15 (12)	3.9 (4)	Controls vs. TS (p=.004) Controls vs. BFRB (p=.017) Controls vs. OCD (p=.004)
Depression (BDI)	14 (11)	17 (9)	17 (8)	3 (4)	Controls vs. TS (p≤.001) Controls vs. BFRB (p≤.001) Controls vs. OCD (p≤.001)
Tics severity (YGTSS)	38 (17)	28 (8)	-	-	T=2.52 (p=.017)
OCD symptoms' severity (YBOCS)	-	-	27 (6)	-	

TS: Tourette Syndrome; BFRB: Body-focused Repetitive Behaviors; OCD: Obsessional-compulsive disorder; Laterality: Edinburgh Handedness Inventory; BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; YGTSS: Yale Global Tic Severity Scale; YBOCS: Yale-Brown Obsessive Compulsive Scale; ns: non-significant. Significant results are defined by a threshold of  $\leq .05$ .



58 TS, OCD and BFRB participants were matched with 59 controls on the basis of age, intelligence and laterality.

### Electrophysiological recordings

50 electrodes distributed across seven distinct regions: antero-frontal, frontal, fronto-central, central, centro-parietal, parietal, parieto-occipital.

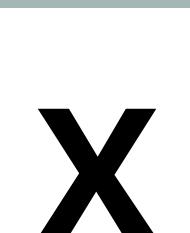
### Event-related potential components

**N200** : Cognitive control index (controlled detection of mismatched stimuli, regulation of response strategy, and response inhibition)

**P200** : Attentional processes (early assessment of stimulus salience and relevance to the task)

**P300** : Evaluation and categorization of stimuli, context updating and working memory

### Counting oddball task



**Rare condition :** The participant must count the number of rare stimuli that appear.



**Frequent condition :** No instruction required.

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## Conclusion

1. No significant intergroups difference were observed for P200 and N200 components when controlling for anxiety and depression.
2. Patients with TS and OCD exhibit deficits in working memory as reflected by a decreased P300 oddball effect in the frontal lobe.
3. BFRB and TS groups show similar activations to the control group regarding the generators of the P300 oddball effect, notably in the cingulate cortex.
4. The OCD group shows activations in the precuneus and the posterior cingulate gyrus as well as in the lingual gyrus and middle occipital gyrus, two regions associated with OCD psychopathology.